

Annual Report

May 2016



eNtSa

innovation through engineering

Strategic partners



**Nelson Mandela
Metropolitan
University**

for tomorrow



technology innovation
A G E N C Y



**science
& technology**

Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

Director's Foreword

In view of the rising trajectory of activities over all the programmes within eNtsa over the past few years I realized that we as eNtsa had to relook our modus operandi. Sir Richard Branson, once suggested that one should be brave enough to sometimes step aside and re-evaluate how things should be done and ponder about the “bigger picture” of what to achieve.

Considering eNtsa's “flight path” and more specifically the 2015/2016 financial year and project data, one realises how well eNtsa performed during the past financial year. In my role as director, I have to admit, that central to achieving this, is a highly motivated and competent group of professional staff, dedicating more than just time, functioning with an attitude for solving complex problems without making excuses for operational constraints.

NMMU and more specifically the Engineering group within the university are very privilege to have an innovation unit like eNtsa, recognized not only nationally but internationally for the knowledge contribution and solution driven engineering support. “eNtsa” people are known for taking responsibility at all levels, embracing the eNtsa philosophy of “innovation through engineering” with an “attitude for altitude”.

The last financial year was launched with a critical evaluation of our current operational structure with a view of developing a restructuring/resizing strategy to ensure we improve organizational effectiveness and reduce human resource cost. However, due to a growing demand for innovative solutions and technology support, we were forced to rethink some of the original ideas. The restructuring, now completed, is aligned to ensure improved internal communication and an enhanced capability to track and deliver on high risk and complex engineering projects.

However, our original plan to resize the human resource component had to be reviewed and adapted to ensure we are in a position to deliver on signed contracts, grant agreements and commercial commitments. Looking back, not something we often do in eNtsa, made us realize that we have come to the end of another demanding but exciting year.

eNtsa's inability to aggressively commercialize some of the developed technologies and service entities remains a challenge and will receive enhanced attention to ensure long-term sustainability and creating professional career path opportunities. The opportunity for eNtsa to benefit from spin-off entities is vast and lies in our ability to form a natural relationship, or, as I often refer to, an umbilical cord relationship with these companies ensuring a sustainable level of income and ensuring eNtsa maintains a knowledge generating research focus.

The 2016/2017 structure attempts to grow an entrepreneurial culture within eNtsa by positioning the different engineering divisions as business units. This is expected to assist with making the move to commercial entities less complex, while ensuring NMMU, through eNtsa, can tackle the next technology and knowledge gap for our industry partners.

Contents

Director's Foreword.....	1
About eNtsa	3
Our vision	4
Our Mission	4
Our slogan.....	4
Our Values.....	4
Our portfolio	5
Engineering	5
uYilo E-mobility Technology Innovation Programme (EMTIP)	6
Composites Innovation Centre	8
Research	8
Commercialisation	9
Operations.....	10
Outputs.....	11
Human Resources	14
Governance.....	17
Financials.....	19

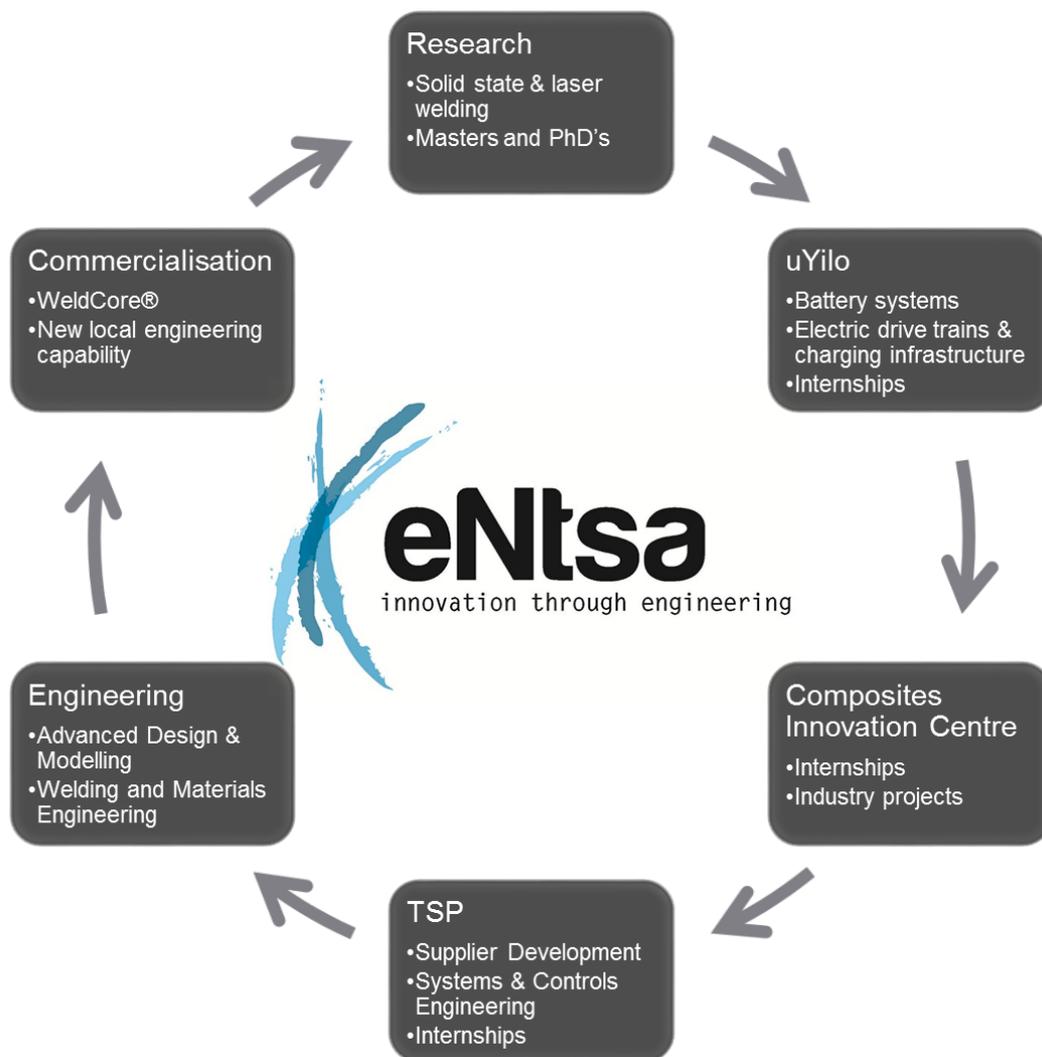
About eNtsa

eNtsa is internationally recognized as a hub of innovation. We are based at Nelson Mandela Metropolitan University with strong strategic relations with the Technology Innovation Agency and the Department of Science and Technology. eNtsa continuously strives to enhance technology innovation and to stimulate a climate of sustainable socio-economic growth in South Africa.

Furthermore, eNtsa's ambition is aligned with the NMMU's Vision & Mission, aiming towards providing an environment generating cutting-edge knowledge and providing a platform for diverse educational opportunities to constructively contribute to a sustainable future, globally.

In 2002 we started off as a Technology Station with three staff members and limited funding and evolved into a preferred center of excellence with a staff compliment of fifty and a turnover in excess of R50m.

This report will provide a synopsis of the areas of focus and capabilities within eNtsa:



OUR VISION

Engineering innovative solutions for a sustainable future

OUR MISSION

To be a workplace of **choice**.

To deliver **innovative engineering solutions** and services.

To facilitate **knowledge and skills development**.

To create new business and **business opportunities**.

To develop a culture of **innovation and entrepreneurship**.

To leverage local and international partnerships for **socio economic growth**.

To develop an organisation that is **adaptable, sustainable and motivated**.

OUR SLOGAN

“Innovation through engineering”

OUR VALUES

Team work

We are committed to common goals.

We expect everyone to actively participate on the eNtsa team.

We openly communicate up, down and across the organization.

Communication build trust and trust builds cohesion.

We value the diversity of our workforce.

We willingly share our resources.

Attitude for altitude.

Integrity

We never compromise our principles or values.

We act with integrity, communicate respectfully and accept responsibility.

We require ethical, professional behaviour by all persons associated.

We conduct our activities in an accountable and transparent manner.

Innovation

We nurture creativity and entrepreneurship.

We take calculated risks to advance innovation.

We learn from our mistakes and do not punish those who make them.

We promote and reward ideas that advance our institution and support sustainable development.

Excellence

We pride ourselves in delivering work that is of the highest quality.

We strive to exceed expectations.

We commit to quality management and continuous improvement.

We take the responsibility for driving tasks and actions.

Our portfolio

ENGINEERING

eNtsa is recognized as a leading research, design and technology support hub for the broader manufacturing sector, with specific focus on automotive components, as well as the power generation- and nuclear industries. eNtsa hosts a number of programmes and projects to enhance engineering related research and development (R&D) efforts within NMMU and the country. Furthermore, eNtsa strives to offer professional and innovative engineering solutions to our stakeholders (national & international) with the aim to increase the economic competitiveness, to contribute to socio-economic growth and support renewable energy technology initiatives in South Africa to attain global attractiveness.

With the support of the Technology Innovation Agency (TIA) and the Department of Science and Technology (DST), this group is equipped to stimulate and enhance innovation and technology within higher education institutions (HEIs) encouraging a multi-disciplinary solution-driven approach and address the need for engineering skills, services and provide training more readily to individuals, small to medium enterprises (SMEs) and large companies according to best international practices.

eNtsa's engineering capabilities have a strong focus on supporting and stimulating local engineering skills in order to support these sectors to exploit and develop new markets. Initiatives that support this drive include the Technology Station Programme (TSP), uYilo eMobility Technology Innovation Programme, various funding platforms and the in-house hosting of modern facilities available to the local companies.

Design and automation capabilities within the team provides direct support to industry as well as to smaller projects through the TSP. eNtsa has expert design competency using various design software platforms which include NX Siemens, Autodesk Inventor, Solidworks and CATIA. The automation areas of proficiency are focused around PLC based automation systems programming, control systems development, embedded systems programming and development, Microsoft .NET software development, mobile development for multiple platforms and electronics and PCB. These skillsets not only provide services to our clients but also supports eNtsa daily operations through maintenance and development of in-house platforms and assistance to research projects with special applications and platform requirements.

Key projects over the past year included the development and integration of a 4th generation WeldCore® platform, the development and integration of six 2nd generation Small Punch Creep Testing platforms, an innovative reserved parking system using a smartphone integrated with a remote server, the development of a 3rd generation Twerly™ solar and wind powered charge controller with a cellular data connection for supporting Wi-Fi roll-out in rural areas and a blade grinding machine for a local manufacturer.

In the past year eNtsa's portable 3D scanning and optical CMM equipment has been utilised in a number of applications. This equipment continues to act as a catalyst for innovation in industry, exposing clients to new technologies and market opportunities. Applications include: scan-based design, reverse engineering, localisation of components, digitisation of handmade items, scan to 3D print and part to CAD comparison for quality assurance and inspection of manufactured components, jigs, checking fixtures and worn components.

These applications have been performed in a variety of industries including: automotive components, rubber technology, wind turbine components and metal casting industries, as well as, assisting the local manufacture of structures for the Square Kilometre Array (SKA) project. As the equipment is portable measurements and scanning can take place on site, allowing for large components to be scanned and/or minimal interruption to processes. The technology has been demonstrated to many new clients and the interest in industry continues to grow with some local companies expressing interest in procuring their own systems.

eNtsa's Welding and Materials capabilities in conjunction with NMMU's Metallurgical Laboratory provides professional analytical competency by conducting comprehensive failure analysis, chemical- and mechanical testing, which is a scarce skill service within the region. This laboratory produces multiple reports with high quality and professional results on a daily basis which assist local manufacturers and OEMs with strategic operational decisions on export readiness and component quality.

UYILO E-MOBILITY TECHNOLOGY INNOVATION PROGRAMME (EMTIP)

The uYilo E-Mobility Technology Innovation Programme (uYilo EMTIP), hosted by NMMU was launched on 13th March 2013. The Programme was initiated by the Technology Innovation Agency (TIA) with the aim to accelerate the development and commercialisation of key electric vehicle (EV) technologies to support the emerging local EV industry. The Programme is structured as a five (5) year national multi-stakeholder innovation programme with three technology focus areas: grid integration, energy storage technology and power train components.

The Programme is open to the entire electro-mobility innovation value chain which includes higher education institutes (HEIs), science councils, small medium micro enterprises (SMMEs), automotive component suppliers, original equipment manufacturers (OEMs), innovators and entrepreneurs. Thus, uYilo connects, facilitates and enables e-mobility technology development across a broad spectrum of national stakeholders.

The Programme has demonstrated value in attracting and accelerating technology development in the E-mobility space, with at least two (2) supported projects showing some commercialisation potential. Further, the Programme acts as a neutral platform to facilitate the public private partnerships between government and industry, most notably the formation of the Electric Vehicle Infrastructure Alliance (EVIA) bears evidence.

The Programme at the NMMU spans across a number of faculties and departments such as engineering, information technology and chemistry, where in its first year of operation it focused on activities to establish and position the Programme to solicit input from the industry and government to define strategic direction. Consequently, with the necessary infrastructure provided at NMMU, facilities were upgraded, expanded and the inherited assets from the Optimal Energy programme are currently being integrated into the demonstration of the live testing environment.

The Programme received commercial support for the commencement of commercial battery testing services for lead acid batteries. With the introduction of the Kick Start Fund in the 2nd year, the programme showed the working of a TIA funding mechanism to be effective within the highly specialised field in order to attract and fund new technologies that have the potential to move to full commercialisation.

An important forum that was established by the programme was the establishment of the national Electric Vehicle Industrial Alliance (EVIA) which has allowed for a range of stakeholders to communicate through a forum. Furthermore, the Programme focused on increasing support to the National System of Innovation (NSI) and to build national expertise in the field of EV through possible co-funding of four (4) strategic projects in order to enable innovation.

The independent operating battery testing laboratory, which forms part of the Programmes capabilities, supports local manufacturing companies by providing accurate and reproducible testing services during the evaluation of new storage solutions whilst providing validation of existing battery technologies. The existing testing services within uYilo extends towards supporting materials characterization and batteries testing across all applications. The battery testing laboratory has acquired SANAS accreditation under ISO 17025 compliance.

The EV Systems Laboratory provides a platform to facilitate EV compatibility with products from a variety of global suppliers to accelerate the development and deployment of electric vehicle technologies into SA. In order to establish a benchmark and help set future research goals, new technologies need to be evaluated from the component level to the vehicle system level for energy consumption and performance. By providing unbiased research results for all stakeholders, we are able to support in evaluating current and future technologies for EV components to aid in the development and optimization of advanced technologies to expand commercial applications in South Africa.

The Live Testing Environment (LTE) serves as a simulator for the EV ecosystem to facilitate universal connectivity between EVs and the electric charging infrastructure. The facility supports analysis, development, and testing of EVs and smart grid technologies to aid in the development and optimization of advanced technologies to expand commercial applications. The facility provides important insight into the vehicle's energy requirements and user acceptance, as well as providing valuable information for OEMs, Utility and Energy companies. This will allow the programme to establish key research projects to further the development and testing of procedures for controlled charging and to establish IT protocol for the feedback of electrical energy usage and its impact on the power grid.

The platform currently consists of testing and development of various EV ecosystem elements such as electric vehicles, charge points and data & information communication systems. The LTE creates a platform with a mix of chargers that consist of private and public AC chargers, a Fast Charger and chargers that will soon be powered by renewable energies that are solar or wind generated. The network will be integrated into a Smart Grid and Energy Management system in order to support future developments such as the incorporation of renewable sources, investigation of vehicle grid technologies and load levelling requirements. The facility allows testing activities that will provide data critical to the development and commercialization of next-generation vehicles.

All uYilo EMTIP initiatives seeks to ready South Africa for the introduction of e-mobility by creating new business opportunities and generating the know-how to support electric vehicles.

COMPOSITES INNOVATION CENTRE

The objective of the Composites Innovation Centre initiative, funded by the CSIR, is to establish a composites engineering footprint by initiating a programme with activities that will create knowledgeable, experienced engineers with a composites capability that can accommodate any composite light-weighting exercise within the research and industrial community.

The project will assist in identifying short-comings in existing composite design, material and manufacturing technologies that may lead to the establishment of additional low Technology Readiness Level (TRL) projects. Through this project the NMMU/eNtsa plan to use and develop local composites engineering technology and apply it in the light-weighting activities. Four individual 'sub-projects' have been identified to address the identified skills requirements within this scope of work.

RESEARCH

Joining technologies, such as solid state welding and laser processing, are the primary areas of research within eNtsa. Research initiatives support NMMU's mission, by identifying and serving the needs of the national and international engineering community by contributing to sustainable development of innovation, knowledge generation and technology transfer.

eNtsa with the assistance of its strategic partners, hosts a variety of state-of-the-art equipment and platforms. In early 2015 eNtsa, in conjunction with the NMMU and the NRF, procured the TruLaser 5020. This platform is a multi-million-rand investment to expand research and technology transfer in the field of laser processing within the institution and local industry. The laser cell is capable of performing laser- cutting, welding and material deposition.

Friction Processing is a field pioneered within the group advancing research boundaries. Expertise has been obtained in Friction Stir Welding, Friction Hydro Pillar Processing, Friction Taper Hydro Pillar Welding and Friction Welding (including Boss Welding, Friction Stud Welding and Hexagonal Bar Welding).

A result of 15 years of research, NMMU, through the efforts of the eNtsa team received international accreditation from the American Society of Mechanical Engineers (ASME) for WeldCore®, a South African developed friction taper hydro-pillar welding and repair process, which has saved the local power generation and petro-chemical industries billions of rands. This status will sanction the application of the technology in high integrity plants and equipment designed and manufactured in accordance of the ASME Boiler and Pressure Vessel Code (BPVC).

The ASME approval positioned the technology to penetrate international regulatory boundaries and has placed NMMU as the first South African HEI to receive approval from this professional body. It is envisaged that over the next couple of years' industrial experience in the application of the process will be evaluated to validate the adoption of this new solid state welding process in the ASME BPVC Section IX. The WeldCore® technology is a prime case study of the ground breaking research hosted at a HEI contributing to the South African socio-economic development.

The majority of the research funding stems from a variety of funders (TIA, NRF, RISP, THRIP, LMI-TiCoC, Eskom, Sasol and TESP) and are expedited according to the respective grant agreements/ contracts in accordance to NMMU financial policies.

COMMERCIALISATION

Commercialisation of developed technologies, engineering services and high technology human resource capability is a key strategic objective for the eNtsa management team. Focus is placed on activities that will enrich the local engineering community, create new economy (jobs) and will support future sustainability of NMMU and eNtsa, through direct (joint projects) and indirect (royalties) partnerships with commercial entities it will incubate.

The eNtsa management team has put in place a commercialisation strategy that addresses the following:

(1) The sustainability of eNtsa:

Income from state owned entities and consulting services are uncertain which complicates longer term planning in an organisation that has more than fifty staff members. Diversification of clients and markets will be required and it is proposed building strong relationship with commercial entities who will firstly work with eNtsa on a project basis and secondly bring in new business through the relationship it will create. eNtsa wishes to become less dependent on high risk consulting type revenues.

A flow of skilled HR between eNtsa and the commercial entity will create a link between the two organisations that will foster collaboration. Furthermore, it will provide the staff with an opportunity to grow their professional careers beyond the limits of the eNtsa environment, if they wish to do so.

(2) Resize / Restructure the unit

eNtsa aims to return to its core focus which is Research and Government supported programmes. Focusing on supporting companies with applied research rather than being involved with the provision of direct high risk services, allowing the group to contribute to the knowledge required and developing the new technologies to advance South Africa's local industries. A restructuring with dedicated resources will help the group to further expand its reach to programmes that will support Water Resource and Maritime Engineering.

In the short term eNtsa management has identified (1) the commercialisation of WeldCore®, (2) the spinning out of Advanced Design Services and (3) creating of a National Life Extension testing facility as the low hanging fruit that will receive attention towards commercialisation.

OPERATIONS

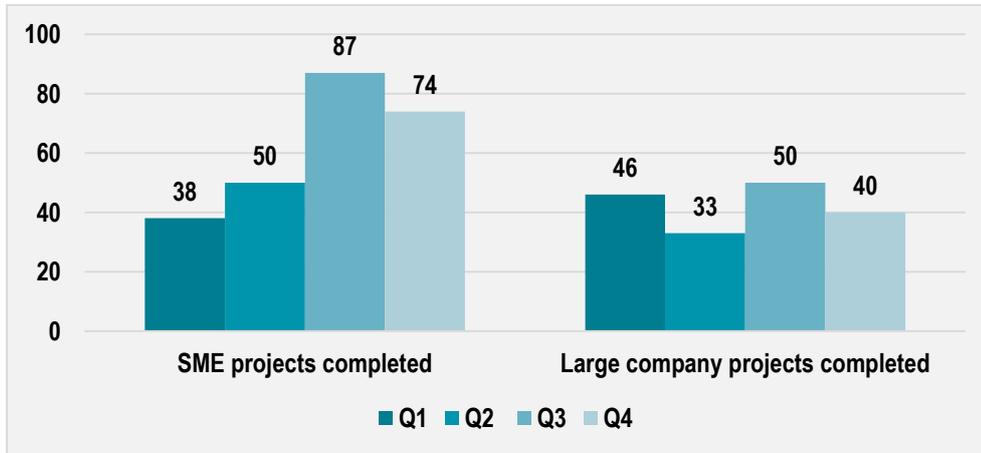
eNtsa's Operations team is a well-integrated group consisting of office professionals, engineering professionals and technical support staff. This group is responsible for the operational function within eNtsa, cohering with official NMMU policies and procedures, which includes human resource management, resource & finance management, marketing, branding, facilities maintenance and general administrative support to the eNtsa team (which includes engineers, researchers and interns).

Staff within this group have a unique scope of skills which provides a distinctive approach in assisting with the service delivery and addressing the demand for interventions within the engineering and innovation sphere. Through strategic planning and industrial feedback, it has become apparent that it is feasible for eNtsa to continue support to these sectors it serves and provide training and short course opportunities addressing the shortfall of skills development initiatives within the local sector.

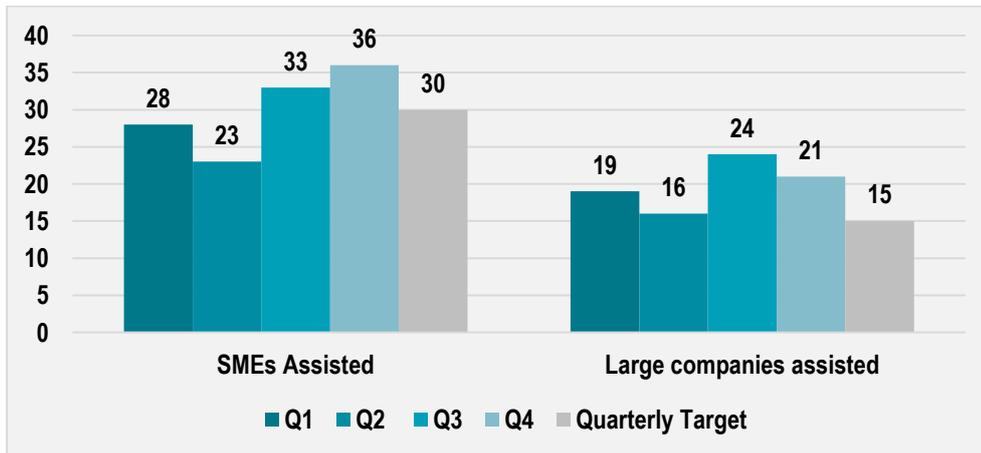
eNtsa believes that growing the engineering and manufacturing economy in South Africa holds the key to sustainable job creation, to improve quality of life and invigorate the socio-economic climate within the country.

Outputs

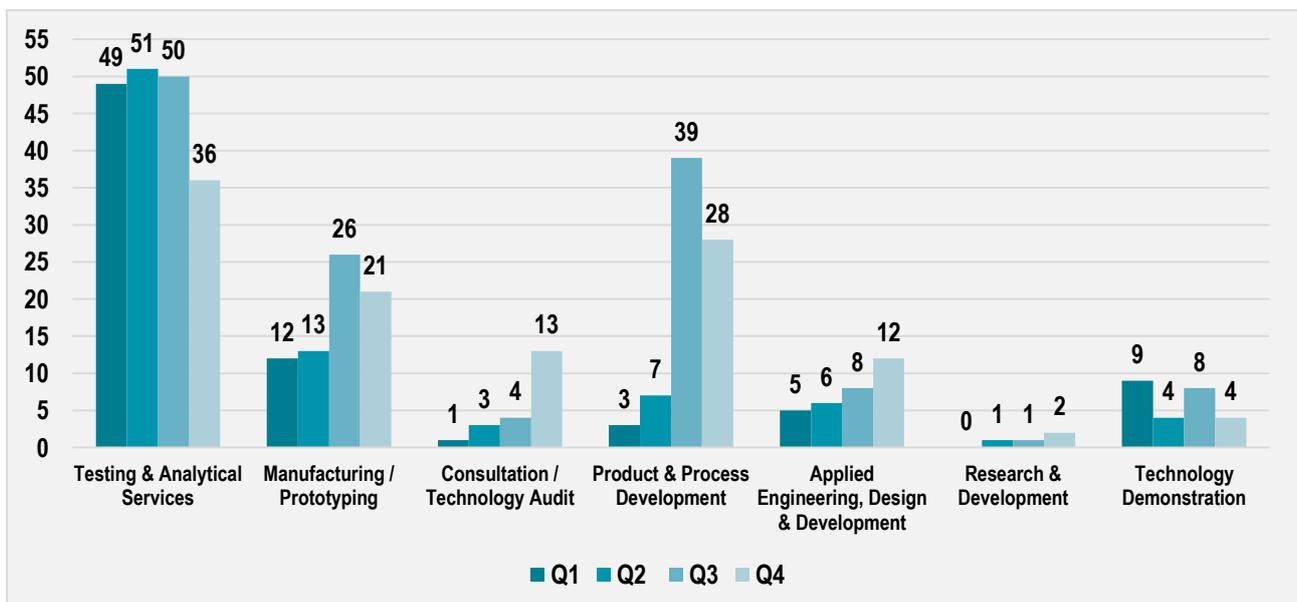
Number of projects completed FY2015/2016



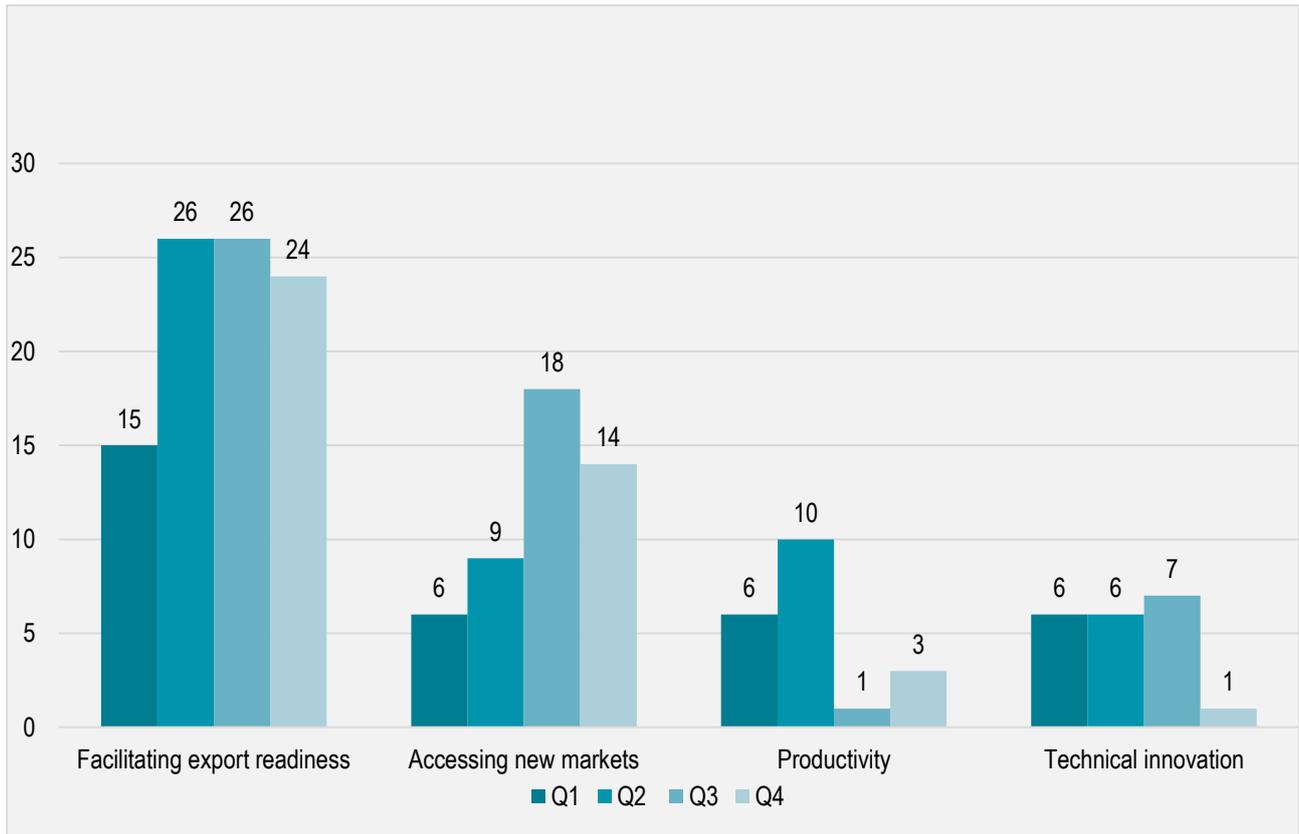
Number of companies assisted in FY2015/2016



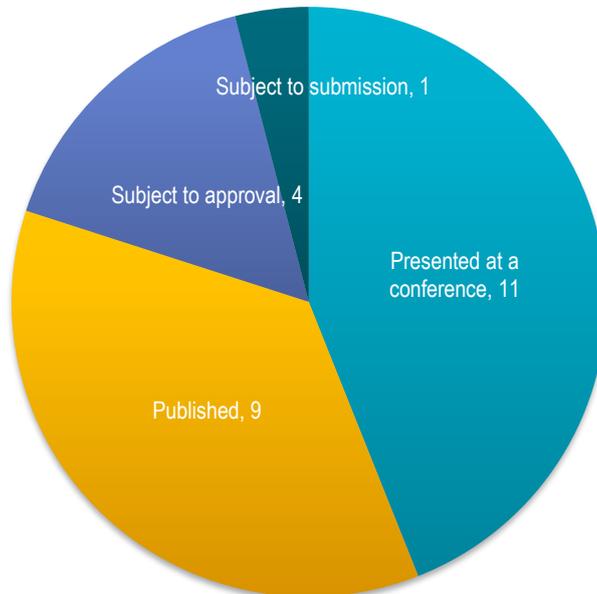
Type of services performed in FY2015/2016



Impact in industry in FY2015/2016



Research Conference and Journal Publications



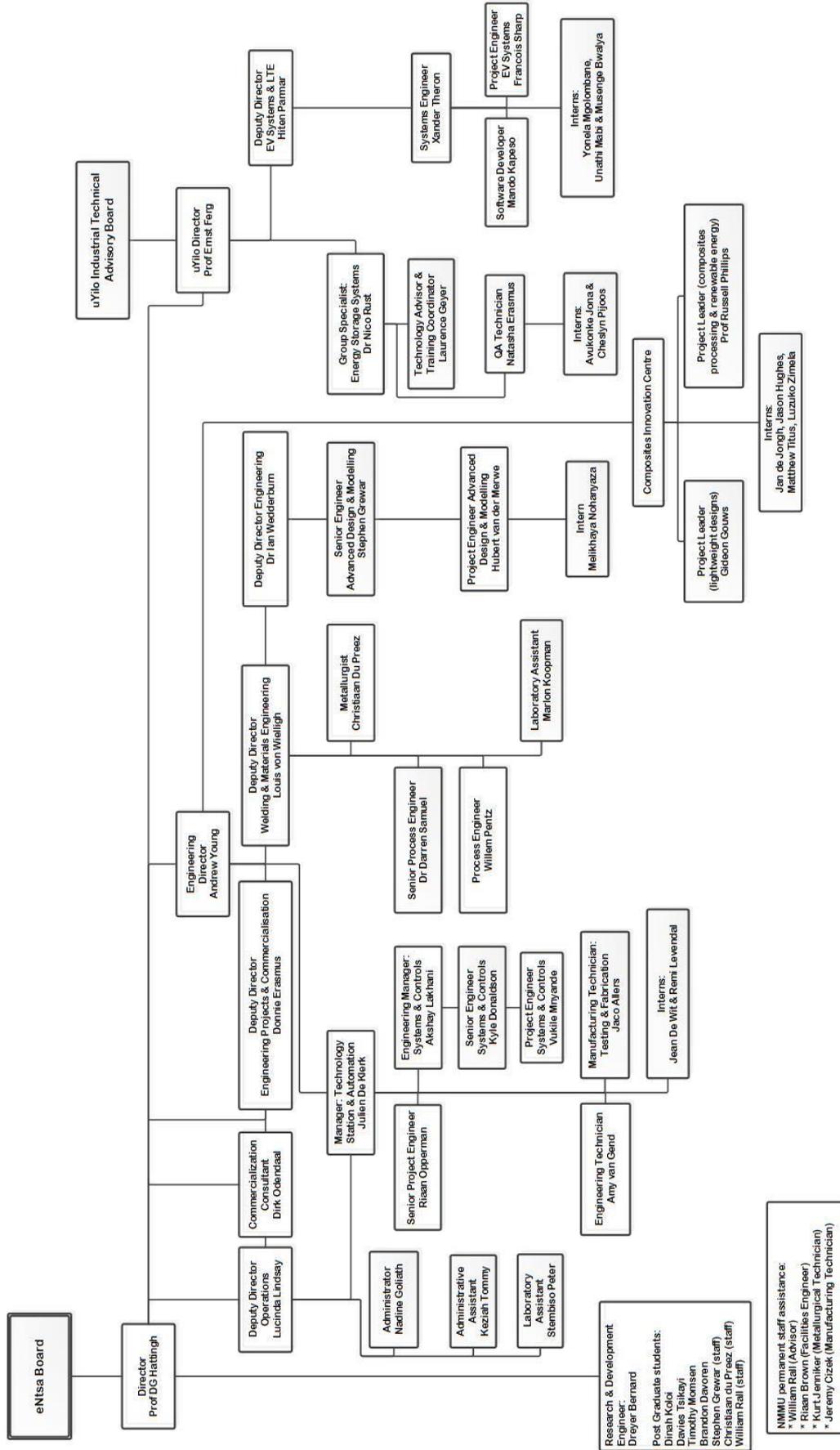
“Back ground” Intellectual Property

Patent title	Description and summary	Inventors	Country	Application type	Application date	Application number	Current status
Friction Welding Apparatus	Novel apparatus for conducting friction hydro pillar processing on plant equipment subject to high temperature and pressure (materials stress fatigue).	DG Hattingh, IN Wedderburn, P Doubell	South Africa	Provisional	28-May-08	2008/04630	-
			Europe	Regional Phase	29-May-09	No. 09793721.3	Abandoned
			USA	National Phase	29-May-09	No. 12/995,014	Abandoned
			PCT	Application	29-May-09	PCT / AZ2009 / 00004	-
			South Africa	National Phase	09-Nov-10	ZA2010/08015	Granted
Method of repairing radially cracked hole	Relates to a method of repairing a radially cracked blade locating hole in a turbine rotor using a friction welding process	L von Wielligh, W Pentz, DG Hattingh, P Doubell	South Africa	Provisional	07-May-12	2012/03293	-
			PCT	Application	06-May-13	PCT / IB2013 / 053608	-
			South Africa	National Phase	19-Feb-14	ZA2014/01252	Granted
Undercutting Tool Arrangement	Apparatus for under cutting tool arrangement utilised in displacing core sample from parent material.	DG Hattingh, IN Wedderburn	South Africa	Provisional	18-Jun-08	2008/05279	-
			PCT	Application	17-Jun-09	PCT / IB2009 / 052571	-
			South Africa	National Phase	18-Jun-08	ZA2008/05279	Granted

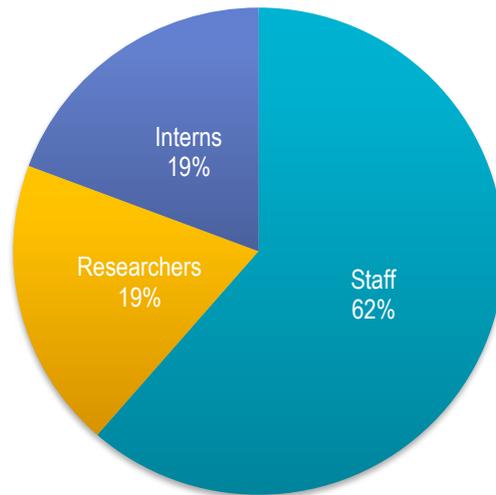
Trade Mark	Description and summary	Inventors	Country	Application type	Application date	Application number	Current status
WeldCore®	Trademark granted in classes 9 and 42 the Trademarks act. Trademark is associated with the WeldCore® apparatus and process.	n/a	South Africa	Trade Mark	10-Mar-10	2010/05041-2	Granted

Human Resources

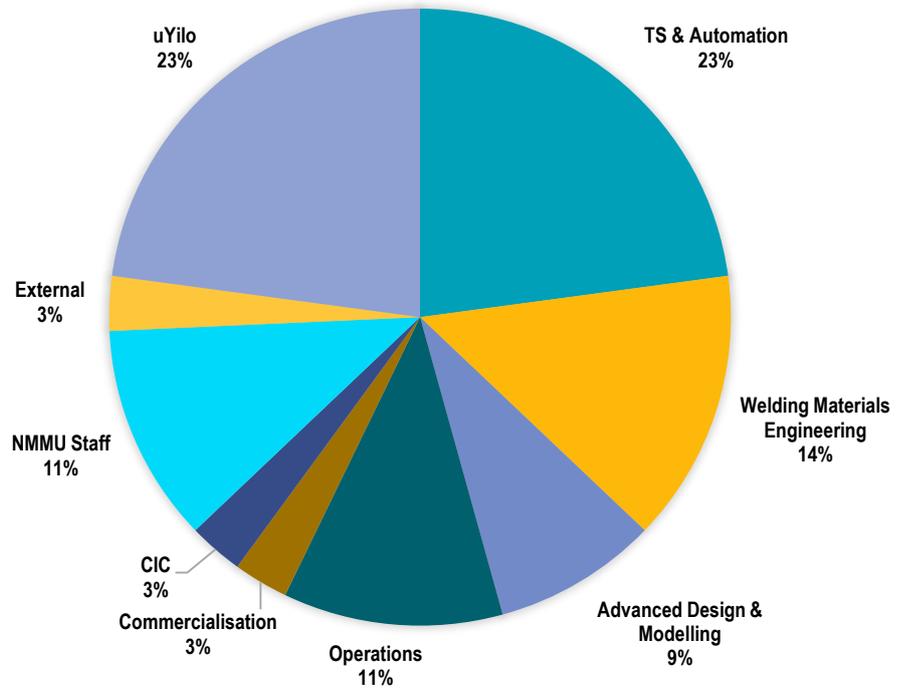
eNtSa structure



GROUPING

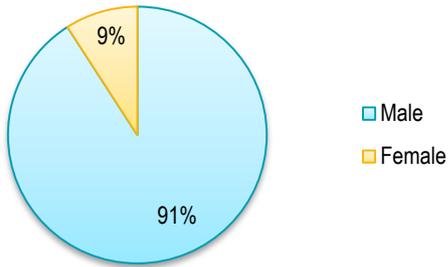


BREAKDOWN OF GROUPS

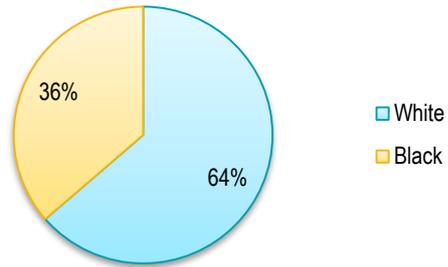


Researchers

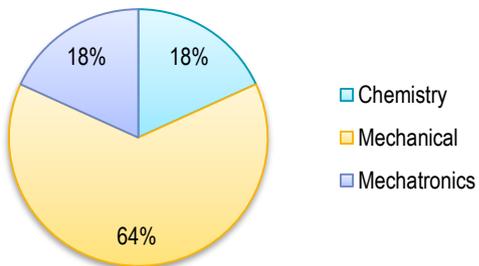
Gender



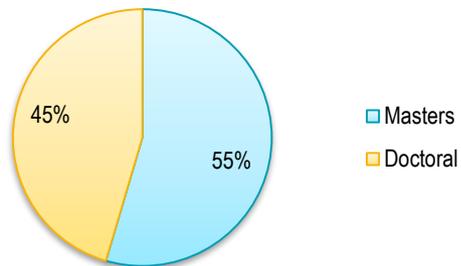
Demographics



Discipline

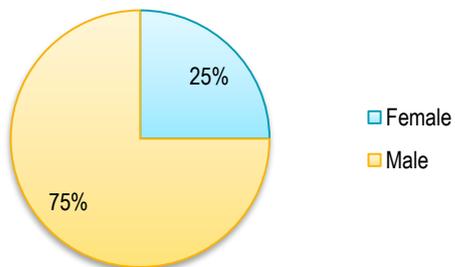


Level

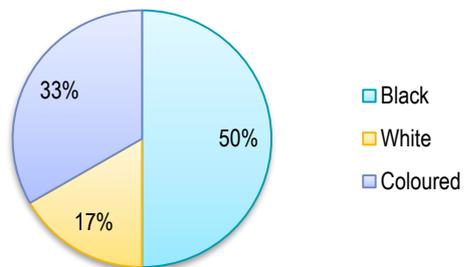


Interns

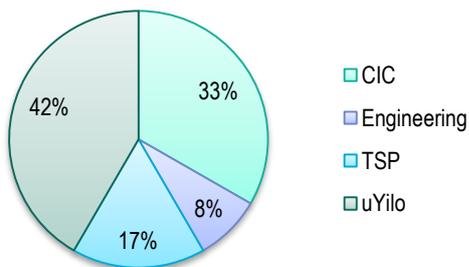
Gender



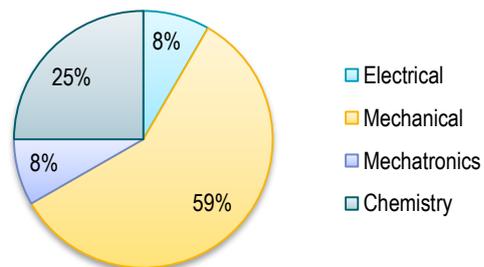
Race



Programme



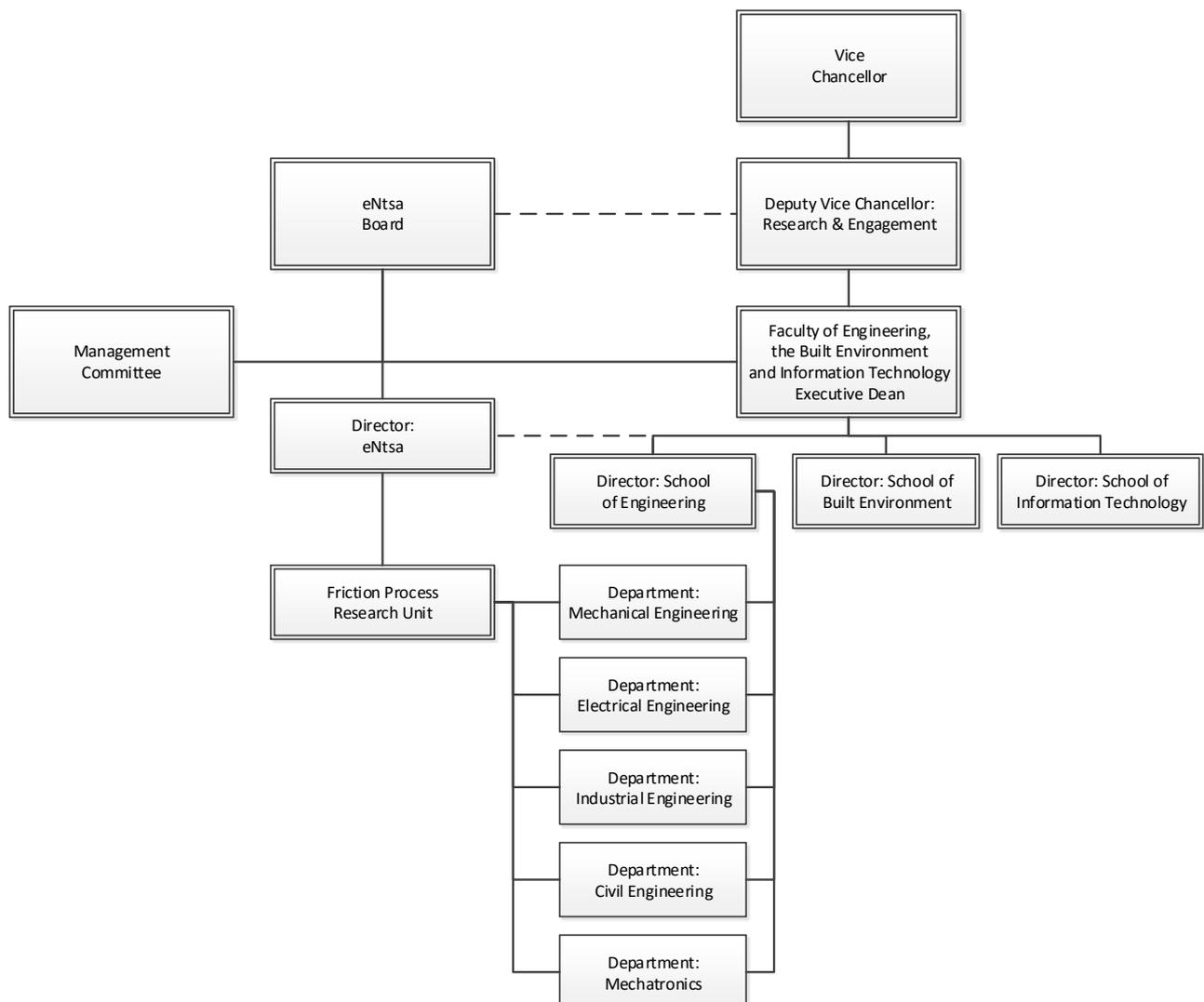
Discipline



Governance

eNtsa has been operating as a separate NMMU group since inception under the directive of the eNtsa Board, chaired by the Executive Dean of EBEIT. Separate cost centres are set up to ensure that all funds (income and expenditures) are properly recorded and managed according to NMMU policy and procedures. A close organizational relationship exists with the Senior Director Finance and Director Innovation Office. Operational matters are directed by the eNtsa Director within policies and coordination with academic leaders and administrative line functions within NMMU. The Director is however assisted by a number of committees, where collective decisions are made, that support all endeavours to successfully manage eNtsa.

NMMU has empowered faculty structures to ensure that maximum benefits (internal as well as external) could be derived from the human-, physical- and intellectual property within the institution. The Deputy Vice Chancellor: Research and Engagement, a member of the Executive Management Committee of the institution, in association with the Executive Dean are responsible for ensuring that operational structures are set up within faculties to allow maximum benefits from units like eNtsa. An integral component of these structures is ensuring a seamless integration between the core business of the institution i.e. teaching and research and the transfer of technology to industry and the community served by the institution. The School of Engineering's position regarding the aforementioned has been strengthened by this strategy. The graphical representation shown below reflects the current position of eNtsa within the structure of the NMMU.



eNtsa Board members

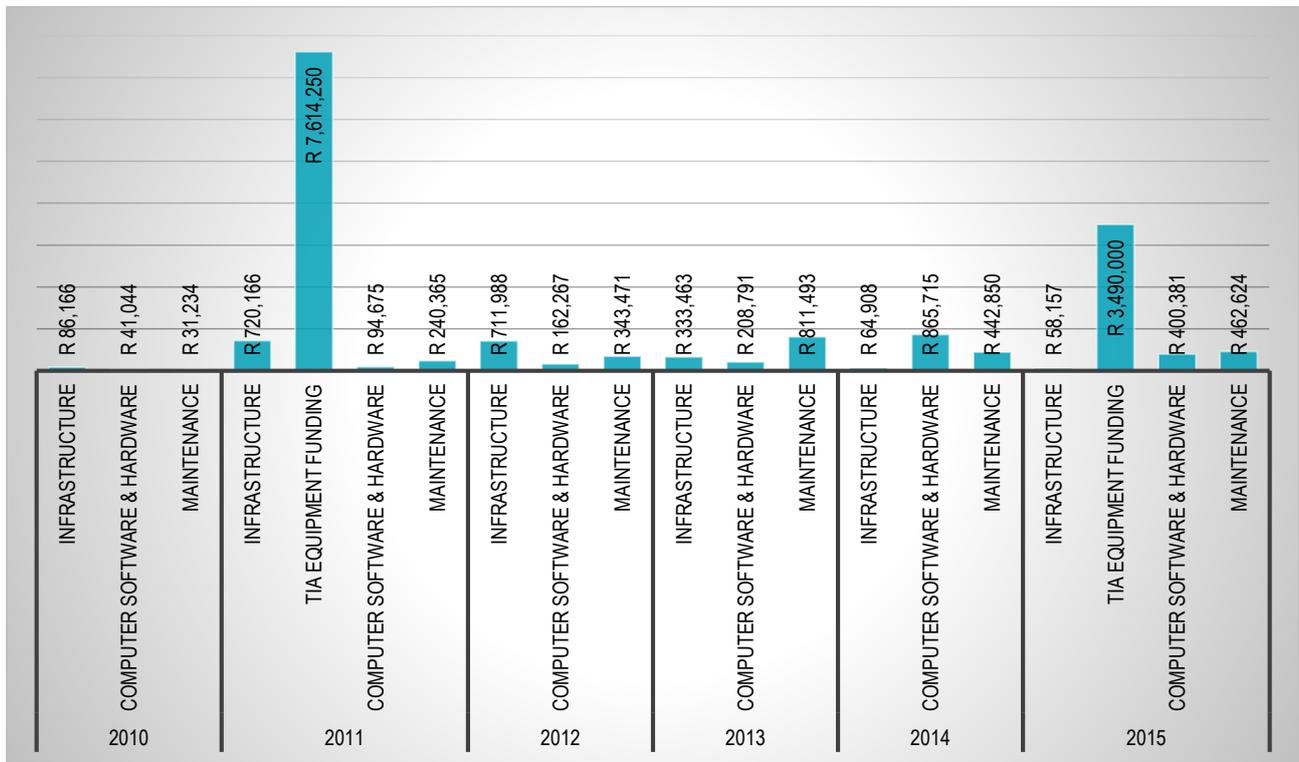
Designation	Name	Portfolio
Executive Dean: Faculty of Engineering, the Built Environment and Information Technology	Dr O Franks (Chair)	Faculty Management Committee Chairperson. Ensure proper management and integration into the Faculty EBEIT. Staff contracts and agreements. As Chairperson, liaise with TIA.
Executive Director: Human Resource	Mr S Hlohlolo	Staff contracts and agreements.
Director: Engagement and Collaboration	Prof G de Lange	External Liaison: Industry: Experiential learning, student involvement & networking with industry.
Senior Director: Finance	Mr J Wasserman	Financial Management: Ensure sound financial management and provide financial statements/reports.
Director: Innovation Office	Ms J Barnett	Innovation Support and Technology Transfer
Director: School of Engineering	Prof K Abou-El-Hosseini	Oversee interaction with laboratories and academic staff across departments. Staff contracts and agreements.
Head of Department: Mechanical Engineering	Mr G Kleyn	Oversee interaction with laboratories and academic staff within Department of Mechanical Engineering.
Director: eNtsa	Prof D Hattingh	Day-to-day management of eNtsa. Prepare all agreements and policies as needed.
Director: uYilo Programme	Prof EE Ferg	Day-to-day management of uYilo Programme. Prepare all agreements as needed.
External Member	Vacant	Interventions - Local and Provincial Government
External Member	Mr T Hayter	Commercialization Specialist
External Member	Mr J Astbury	Industry
External Member	Mr T Mtati	SMEs
TIA Representative	Ms C Twala / Mr V Skosana	Representing TIA
Chairperson of the Staff Trust	Mr A Barton	Representing the Staff Trust

eNtsa Management Committee members

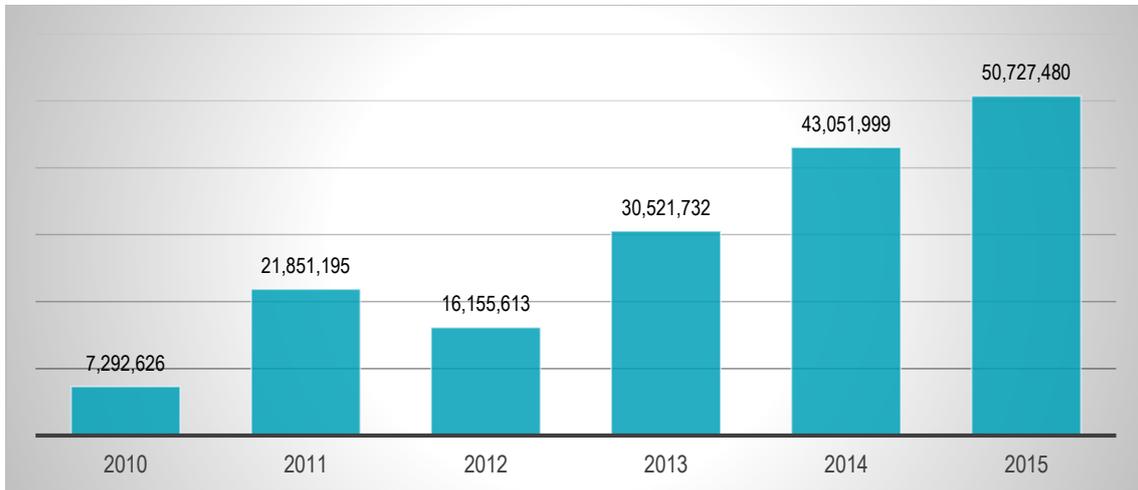
Designation	Name
Director: eNtsa	Prof Danie Hattingh (secondary appointment)
Director: uYilo Programme	Prof Ernst Ferg (secondary appointment)
Engineering Director	Andrew Young
Deputy Director: Engineering	Dr Ian Wedderburn
Deputy Director: Operations	Lucinda Lindsay
Deputy Director: uYilo LTE & EV	Hiten Parmar
Deputy Director: Engineering Projects & Commercialisation	Donnie Erasmus

Financials

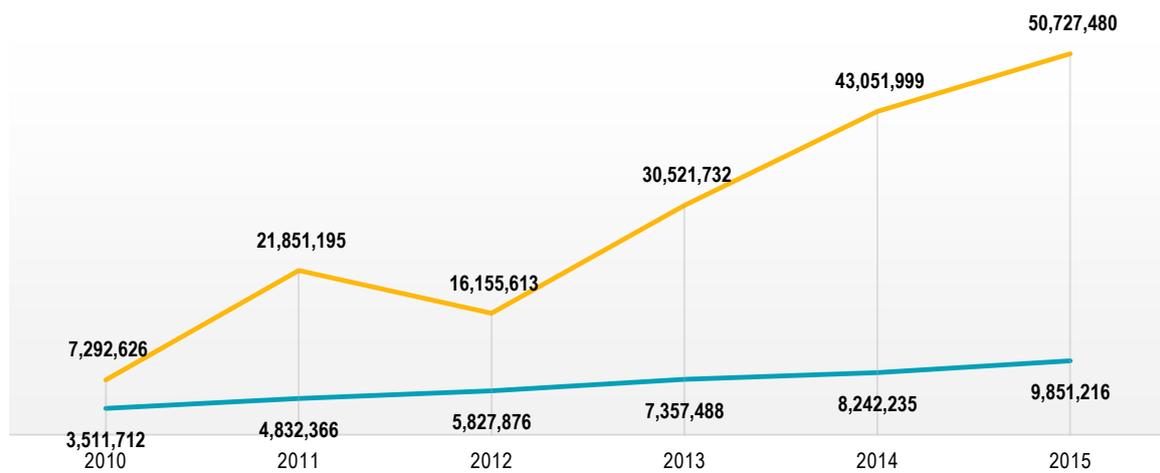
The graph below depicts the monetary value spent on infrastructure, computer hardware & software and maintenance on equipment since 2010.



The graph below depicts eNtsa turnover since 2010:



The graph below depicts eNtsa Human Resource Expense vs Turnover since 2010:



The graph below depicts eNtsa Income sources for the FY2015/2016:

